

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

U.S. Patent Application No.:	09/998,469)	
Filing Date:	November 29, 2001)	Group Art Unit: 2814
For:	Barrier Layers For Protecting Metal Oxides From Hydrogen Degradation)	Examiner: Peralta, Ginette
Applicants:	Solayappan et al.)	Docket No.: 13176.403
)	Confirmation No.: 5686
)	Attachment to Paper No.: 11

CERTIFICATE OF TRANSMISSION UNDER 37 CFR 1.8

I hereby certify that this correspondence, along with all papers referred to as being transmitted, are being facsimile transmitted to the Patent and Trademark Office Fax No. (703) ~~892-7700~~ 872-~~7700~~ *9306*

November 14th 2003
Date

Elaine C. VonSpreckelsen
Elaine C. VonSpreckelsen

DECLARATION OF LARRY D. McMILLAN

I, Larry D. McMillan, hereby declare:

1. I am President and CEO of Symetrix Corporation at 5055 Mark Dabling Boulevard, Colorado Springs, Colorado, where I am involved in directing various research and business activities, which include integrated circuit manufacturing process development. All statements made herein of my own knowledge are true, and all statements made on information and belief are believed to be true.

2. I have worked for over forty years as an integrated circuit process engineer. I have published more than a hundred papers and presentations on the subject of integrated circuit process engineering and have more than 75 issued US patents in the field. A copy of my curriculum vitae with a partial list of my papers and patents is attached hereto.

3. Symetrix Corporation (Symetrix) is the assignee of the above-designated patent application (hereinafter "the application").

4. I submit this Declaration to present to the Examiner, in an authenticated manner, facts concerning the relevance of the references cited in the Final Office Action dated June 16, 2003 (hereinafter "the Office Action").

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5. I have read the present claims of the application, the Final Office Action, and the references cited by the Examiner, particularly, U.S. Patent Application Publication No. U.S. 2002/0038402 A1, published March 28, 2002, naming Kanaya (hereinafter "Kanaya"), and U.S. Patent No. 6,351,004 B1, issued February 26, 2002 to Shimada et al. (hereinafter "Shimada").

6. The Shimada reference does not say that second insulating layer 8 prevents oxidation of source 3 and drain 4.

7. It is not inherently clear that an oxide second insulating layer 8 as disclosed in Shimada would protect against oxidation, because an oxide layer is typically already saturated with oxygen.

8. Shimada does not mention or discuss using second insulating layer 8 as a hydrogen barrier layer or as any other type of diffusion barrier.

9. In the Shimada reference, the purpose and the principle of operation of second insulating layer 8 is its role as an electrical insulator between floating electrode 9 on one side and source 3, drain 4, and tunnel-barrier insulator 5 on the other side.

10. Permittivity is directly related to the dielectric constant of a material by the equation

$$\epsilon = K\epsilon_0,$$

where ϵ is permittivity, K is a relative dielectric constant, and ϵ_0 is the permittivity of a vacuum.

11. There is absolutely no suggestion or motivation either in the references or in the prior art in general to combine the teaching of high-permittivity second insulating layer 8 from Shimada with the teaching of hydrogen barrier layer 402 of Kanaya.

12. There is absolutely no suggestion or motivation either in the references or in the prior art in general to combine the teaching of high-permittivity second insulating layer 8 from Shimada with the teaching of any insulating interlayers of Kanaya.

13. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements

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further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

November 13, 2003
Date


Larry D. McMillan

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Larry D. McMillan

CURRICULUM VITAE

EDUCATION

Ph.D. (Candidate) University of Colorado at Colorado Springs
M.S.E.E. Arizona State University, 1972
B.S. Aquinas College, 1965 (physics and mathematics)

Michigan Technological University, 1986-1993
Adjunct Professor

EXPERIENCE

1988-Present Symetrix Corporation
President and CEO
Corporate Management. Ferroelectric and other proprietary materials research and development, process and device development, program management and planning.

1984-1988 Ramtron Corporation
Vice President (R&D) and Corporate Founder
Member, Ramtron Board of Directors. Research and development of ferroelectric memory devices and integrated circuits. Primary investigations of phase three potassium nitrate and other ferroelectric materials.

1982-1984 Honeywell, Inc.
MOS Operations Manager
All MOS operations including wafer fabrication, maintenance, device engineering, process engineering, product engineering, test engineering, CAP/CAM, production testing and new process development. Member of Key Management Group (Corporate Level).

Manager, MOS Advanced Development
CAP/CAM development, CMOS process development, CCD TCL sensor process development, process transfers and long range planning activities. Developed and taught Operator and Technician Level IC Processing course (Honeywell Certificate Program).

MOS Process Engineering Manager
MOS production process engineering, maintenance, CCD process transfer from R&D to production, 3" to 4" wafer conversion, and advanced silicon gate MOS process development.

Larry D. McMillan

- 1980-1982 Stephenson Western, Inc.
Vice President
Engineering Consultant to the semiconductor industry. Computer modeling, fab design, UPDI water system design, process equipment selection, EPA regulations and hazardous chemical disposal. (Customer base included: Motorola, General Electric, Monolithic Memories, Fairchild, Signetics, Storage Technology, Intel and Mitel. (The firm was purchased by The Thomas Group.)
- 1979-1980 Storage Technology Corporation
Vice President and General Manager of Microtechnology Operations
Organized, staffed, designed and facilitated startup of semiconductor and thin film head and thin film media R&D and production facility.
- 1977-1979 National Cash Register (NCR) Corporation
Director of Engineering
All research, development and program management activities at the Colorado Springs NCR Integrated Circuit facility.
- 1976-1977 American Microsystems, Inc.
Manager, CMOS Process Engineering
All aspects of silicon gate CMOS process engineering, including process control and process development. VMOS and UMOS process development and transfer of NMOS process to Pocatello, Idaho facility. Developed and taught Operator and Technician Level Mathematics course.
- 1966-1976 Motorola, Inc.
Manager, Device Engineering (1975-1976)
Silicon gate NMOS fab device engineering and production process control. Established LPCVD silicon nitride and poly silicon as production processes in Austin, Texas facility.
- Staff Scientist, Advanced Product R & D Labs (1973-1975)
Process development of 4K and 16K NMOS RAMS. Multi-level metal MOS development, spin-on metallic oxide development, and LPCVD poly silicon and silicon nitride development.

Larry D. McMillan

CURRICULUM VITAE

Manager, Linear IC Wafer Engineering (1973-1970)

Expanded Mesa, Arizona linear IC manufacturing capability from 2,000-2" wafers to 14,000-3" wafers per week. Linear device engineering, specification control, process control, wafer process engineering, linear process development, HIREL pilot line and wafer test. Developed and taught Engineering Level Process Engineering Classes (Motorola Certificate Program).

Engineering Manager, Product Engineering Liaison (1969-1970)

Safeguard Missile Program (secret). Beam lead processing.

Engineer, Motorola Advanced Pilot Line (1967-1969)

Photoresist, metalization, product development.

Engineer, Motorola Training Program (1966-1967)

MOS process development, C-V analysis, multi-layer metal, Epi, materials research, packaging.

Larry D. McMillan

Publications and Presentations

Publications and Presentations

C.A. Paz de Araujo, **L. D. McMillan**, Z. Chen, Y. Shimada, Y. Kato, T. Otsuki, "Ferroelectric Linked Cell Device Physics", abstract presented at *The Proceedings of the 13th International Symposium on Integrated Ferroelectrics*, Colorado Springs, CO, March 2001.

Z. Chen, M. Lim, V. Joshi, Carlos A. Paz de Araujo, **L. D. McMillan**, "Advanced Simulation Tool For FeRam Design", abstract presented at *The Proceedings of the 13th International Symposium on Integrated Ferroelectrics*, Colorado Springs, CO, March 2001.

M. Lim, Z. Chen, V. Joshi, **L. D. McMillan**, C.A. Paz de Araujo, "Random Accessibility of Ferroelectric FET As A Nonvolatile Non-Destructive Read Out (NDRO) Memory", abstract presented at *The Proceedings of the 13th International Symposium on Integrated Ferroelectrics*, Colorado Springs, CO, March 2001.

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Y. Shimada, U. Kato, T. Yamada, T. Otsuki, Z. Chen, M. Lim, V. Joshi, **L. D. McMillan**, C. Paz de Araujo, "High Density and Long Retention Non-Destructive Readout FeRAMs using a Linked Cell Architecture", abstract presented at *The Proceedings of the 13th International Symposium on Integrated Ferroelectrics*, Colorado Springs, CO, March 2001.

Z. Chen, N. Solayappan, V. Joshi, K. Laetz, C.A. Paz de Araujo **L. D. McMillan**, "1K FeRam-Based Smart Card Application For Handspring Visor", abstract presented at *The Proceedings of the 13th International Symposium on Integrated Ferroelectrics*, Colorado Springs, CO, March 2001.

J. Karasawa, Y. Hamada, K. Ohashi, E. Natori, K. Oguchi, T. Shimoda, V. Joshi, **L. D. McMillan**, C. Paz de Araujo, "Effect of Process Condition on Microstructure of Thin SBT-Based Films", abstract presented at *The Proceedings of the 13th International Symposium on Integrated Ferroelectrics*, Colorado Springs, CO, March 2001.

S. Narayan, V. Joshi, J. Celinska, M. Lim, **L. D. McMillan**, C.A. Paz de Araujo, "Strontium Bismuth Tantalate Thin Films on IrO_x Bottom Electrodes For High Density FeRam Applications", abstract presented at *The Proceedings of the 13th International Symposium on Integrated Ferroelectrics*, Colorado Springs, CO, March 2001.

L. D. McMillan, C.A. Paz de Araujo, S. Narayan, V. Joshi, "The Limits of Thickness Scaling in PZT and SBT and Its Effect on Reliability", abstract presented at *The Proceedings of the 13th International Symposium on Integrated Ferroelectrics*, Colorado Springs, CO, March 2001.

J. Celinska, V. Joshi, S. Narayan, **L. D. McMillan** and C.A. Paz de Araujo, "Low Temperature Process for Strontium Bismuth Tantalate Thin Films", abstract presented at *The Proceedings of the 12th International Symposium on Integrated Ferroelectrics*, Aachen, Germany, March 2000.

Larry D. McMillan**Publications and Presentations**

V. Joshi, N. Solyappan, J. Celinska, L.D. McMillan, C.A. Araujo, "A 650° C Process For Strontium Bismuth Tantalate thin films", abstract presented at The Proceedings of the 12th International Symposium on Integrated Ferroelectrics, Aachen, Germany, March 2000.

N. Solyappan, C. A. Paz de Araujo and **L. D. McMillan**, "Status of Advanced LSMCD for Y-1 Deposition," invited paper published in *Science Forum, Inc.*, Tokyo, 1999.

C. A. Paz de Araujo, N. Solyappan, **L. D. McMillan**, T. Otsuki and K. Arita, "Process Integration of Embedded FeRAMs", invited paper published in *Jour. ElectroCeramics, Special Issue*, 1999.

S. Narayan, V. Joshi, **L. D. McMillan** and C. Paz De Araujo, "Sub-100 nm SBT Films for Low Voltage and High Density FeRam Applications", *Proceedings of the 11th International Symposium on Integrated Ferroelectrics*, Colorado Springs, CO, Vol. 25, pp.509-517, March 1999.

M. Lim, J.W. Bacon, **L. D. McMillan** and C.A. Paz De Araujo, "SBT-Based Ferroelectric FET for Nonvolatile Non-Destructive Read Out (NDRO) Memory Applications", *Proceedings of the 11th International Symposium on Integrated Ferroelectrics*, Colorado Springs, CO, Vol. 27, pp. 1115-1124, March 1999.

N. Solayappan, V. Joshi, A. DeVilbiss, J. Bacon, J. Cuchiario, **L. D. McMillan** and C. A. Paz de Araujo, "Chemical Solution Deposition (CSD) and Characterization of Ferroelectric and Dielectric Thin Films", *Integrated Ferroelectrics*, Vol. 22, pp. 521-531, 1998

C. A. Paz de Araujo, T. Otsuki, J. Cuchiario and **L. D. McMillan**, "Microcontrollers with Ferroelectric Embedded Memory", presented at *IEEE 1998 International Nonvolatile Memory Technology Conference*, June 22-24, Albuquerque, NM, 1998.

E. Fujii, T. Otsuki, Y. Judai, Y. Shimada, M. Azuma, Y. Uemoto, Y. Nagano, T. Nasu, Y. Izutsu, A. Matsuda, K. Nakao, K. Tanaka, K. Hirano, T. Ito, T. Mikawa, T. Kutsunai, **L. D. McMillan** and C. A. Paz de Araujo, "Highly Reliable Ferroelectric Memory Technology with Bismuth-Layer Structured Thin Films (Y-1 Family)", *IEDM, IEEE*, July 1997, pp. 597-600.

J.D. Cuchiario, V. Joshi, C.A. Paz de Araujo, and **L. D. McMillan**, "On the Voltage Linearity and Scalability of Thin Film High Capacitance Density Using $[X(\text{Ba}_{n1}\text{Sr}_{n2}(\text{Nb,Ta})_{10}\text{O}_{30} + (1-x)\text{SrTiO}_3]$ Solid Solutions," presented at *The 9th International Symposium on Integrated Ferroelectrics*, Santa Fe, NM, March 1997, to be published in 1998.

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H. Uchida, N. Soyama, K. Kageyama, K. Ogi, M.C. Scott, J. D. Cuchiario, **L. D. McMillan**, and C.A. Paz de Araujo, "Characterization of Self-Patterned SBT/SBNT Thin Films from Photo-Sensitive Solutions," *Proceedings of the 9th International Symposium on Integrated Ferroelectrics*, Santa Fe, NM, Vol. 18, pp. 749-761, March 1997.

Larry D. McMillanPublications and Presentations

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N. Solayappan, G.F. Derbenwick, **L. D. McMillan**, C.A. Paz de Araujo, and S. Hayashi, "Conformal LSMCD Deposition of $\text{SrBi}_2(\text{Ta}_{1-x}\text{Nb}_x)_2\text{O}_9$," *Proceedings of the Eighth International Symposium on Integrated Ferroelectrics*, Tempe, AZ, Part I, Vol. 14, pp. 237-246, 1997.

H. Uchida, N. Soyama, K. Kageyama, K. Ogi, M.C. Scott, J.D. Cuchiaro, G.F. Derbenwick, **L. D. McMillan**, and C.A. Paz de Araujo, "Characteristics of Self-Patterned $\text{SrBi}_2\text{Ta}_2\text{O}_9$ Thin Films from Photo-Sensitive Solutions," *Proceedings of the Eighth International Symposium on Integrated Ferroelectrics*, Tempe, AZ, Part III, Vol. 16, pp. 41-52, 1997.

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C.A. Paz de Araujo, J. Cuchiaro, V. Joshi, A. DeVilbiss, **L. D. McMillan**, and M. Azuma, "Characterization and Optimization of $\text{A}_{m-1}\text{Bi}_2(\text{Ta}_{1-x}\text{Nb}_x)_m\text{O}_{3m+3}$ Layered Perovskites using Rayleigh's Analysis," abstract presented at *The Proceedings of the Eighth International Symposium on Integrated Ferroelectrics*, Tempe, AZ, March 1997.

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F.M. Ross, K.M. Krishnan, N. Thangaraj, R.F.C. Farrow, R.F. Marks, A. Cebollada, S.S.P. Parkin, M.J. Toney, M. Huffman, C.A. Paz de Araujo, **L. D. McMillan**, J. Cuchiaro, M.C. Scott, C. Echer, F. Ponce, M.A. O'Keefe, and E.C. Nelson, "Applications of Electron Microscopy In Collaborative Industrial Research," from *MRS Bulletin*, Vol. 21, No. 5, pp. 17-23, May 1996.

Larry D. McMillan**Publications and Presentations**

N. Soyama, H. Uchida, K. Kageyama, K. Ogi, M.C. Scott, J.D. Cuchiaro, G.F. Derbenwick, **L. D. McMillan**, and C.A. Paz de Araujo, "Preparation of Self-Patterned $\text{SrBi}_2\text{Ta}_2\text{O}_9$ Thin Films from Photo-Sensitive Solutions," *Materials Research Society Symposium Proceedings*, Vol. 433, San Francisco, CA, pp. 91-96, April 1996.

T. Ito, S. Hiraide, H. Yoshimori, H. Watanabe, T. Mihara, C.A. Paz de Araujo, M.C. Scott, and **L. D. McMillan**, "Characteristics of Low Temperature Annealed $\text{SrBi}_2\text{Ta}_2\text{O}_9$," abstract presented at *The Proceedings of the Seventh International Symposium on Integrated Ferroelectrics*, Colo. Spgs., CO, March 1995.

V. Joshi, J.D. Cuchiaro, **L. D. McMillan**, and C.A. Paz de Araujo, "Stoichiometry Control of Spin-on $\text{SrBi}_2\text{Ta}_2\text{O}_9$ Ferroelectric Thin Films," abstract presented at *The Proceedings of the Seventh International Symposium on Integrated Ferroelectrics*, Colo. Spgs., CO, March 1995.

S. Hayashi, M. Azuma, Y. Oishi, T. Otsuki, M. Huffman, **L. D. McMillan**, and C.A. Paz de Araujo, "Preparation and Characterization of Y-1 Capacitors by Misted Deposition Technique," abstract presented at *The Proceedings of the Seventh International Symposium on Integrated Ferroelectrics*, Colo. Spgs., CO, March 1995.

T. Mihara, H. Yoshimori, H. Watanabe, T. Itoh, C.A. Paz de Araujo, and **L. D. McMillan**, "Superior Electrical Characteristics of Bi-layered Perovskite Thin Film and Comparison with PZT," abstract presented at *The Proceedings of the Seventh International Symposium on Integrated Ferroelectrics*, Colo. Spgs., CO, March 1995.

Y. Oishi, M. Azuma, S. Hayashi, **L. D. McMillan**, and C.A. Paz de Araujo, "Electrical Characteristics of Mn Doped Thin Film BST," abstract presented at *The Proceedings of the Seventh International Symposium on Integrated Ferroelectrics*, Colo. Spgs., CO, March 1995.

T. Sumi, N. Moriwaki, G. Nakane, T. Nakakuma, Y. Judai, Y. Uemoto, Y. Nagano, S. Hayashi, M. Azuma, T. Otsuki, G. Kano, J.D. Cuchiaro, M.C. Scott, **L. D. McMillan**, and C.A. Paz de Araujo, "256Kb Ferroelectric Nonvolatile Memory Technology for 1T/1C Cell with 100ns Read/Write Time at 3V," *Integrated Ferroelectrics*, Part 1, Vol. 6, pp. 1-13, 1995.

J.F. Scott, D. Galt, J.C. Price, J.A. Beale, R.H. Ono, C.A. Paz de Araujo, and **L. D. McMillan**, "A Model of Voltage-Dependent Dielectric Losses for Ferroelectric MMIC Devices," *Integrated Ferroelectrics*, Part 1, Vol. 6, pp. 189-203, 1995.

T. Otsuki, T. Sumi, E. Fujii, Y. Judai, Y. Shimada, N. Moriwaki, Y. Uemoto, M. Azuma, S. Hayashi, Y. Oishi, K. Arita, A. Inoue, T. Nagano, **L. D. McMillan**, and C.A. Paz de Araujo, "Ferroelectric Thin Film and Integration Technology, '95 MOCVD Workshop for Silicon Processing," Kyungju, Korea, pp. 224-226, 1995.

J.W. Gregory, J.D. Cuchiaro, C.A. Paz de Araujo, and **L. D. McMillan**, "The Effect of Thin Film Scaling on the Capacitance versus Voltage Characteristic of a Ferroelectric Memory Cell," *Integrated Ferroelectrics*, Part 1, Vol. 6, pp. 281-288, 1995.

Larry D. McMillan**Publications and Presentations**

Y. Shimada, Y. Nagano, E. Fujii, M. Azuma, Y. Uemoto, T. Sumi, Y. Judai, S. Hayashi, N. Moriwaki, J. Nakane, T. Otsuki, C.A. Paz de Araujo, and **L. D. McMillan**, "Integration Technology of Ferroelectrics and The Performance of the Integrated Ferroelectrics," *Proceedings of the Seventh International Symposium on Integrated Ferroelectrics, Colo. Spgs., CO, Vol. 11, Part 11, pp. 229-245, September 1995.*

C.A. Paz de Araujo, J.D. Cuchiaro, **L. D. McMillan**, M.C. Scott, and J.F. Scott, "Fatigue-Free Ferroelectric Capacitors with Platinum Electrodes," *Nature*, Vol. 374, pp. 627-629, April 1995.

L. D. McMillan, "Deposition of Barium Strontium Titanate and Strontium Titanate via Liquid Source Chemical Vapor Deposition", *Integrated Ferroelectrics*, Vol. 00, pp. 000-000, 1994.

J.F. Scott, C.A. Paz de Araujo, **L.D. McMillan**, "Ferroelectric Thin Films and Thin Film Devices", *Ferroelectric Ceramics*.

C.A. Paz de Araujo, B.M. Melnick, **L.D. McMillan**, "The Impact of Space Charge on the Measurement of the Dielectric Constant Using the C-V Method in Ferroelectric Memories", abstract.

M. Huffman and **L. D. McMillan**, "Liquid Source Misted Chemical Deposition: Technology Status and Recent Results", presented at the 2nd *Pacific Rim Conference on Ferroelectric Applications*, Melbourne, Australia, November, 1994.

L. D. McMillan, "Deposition of Barium Strontium Titanate and Strontium Titanate via Liquid Source Chemical Vapor Deposition", *Condensed Matter News*, Vol. 3, No. 4, 1994, p. IX, *Integrated Ferroelectrics*, Vol. 5, pp. 97-102, 1994.

T. Mihara, C.A. Paz de Araujo, J.D. Cuchiaro, H. Watanabe, and **L.D. McMillan**, "Feasibility for Memory Devices and Electrical Characterization of Newly Developed Fatigue Eliminated Ferroelectric Capacitors".

L. D. McMillan, M. Huffman, T.L. Roberts, M.C. Scott, and C.A. Paz de Araujo, "Deposition of $\text{Ba}_{1-x}\text{Sr}_x\text{TiO}_3$ and SrTiO_3 via Liquid Source CVD (LSCVD) for ULSI Drams," *Integrated Ferroelectrics*, Vol. 4, pp. 319-324, 1994.

J.F. Scott, M. Azuma, C.A. Paz de Araujo, **L. D. McMillan**, M.C. Scott, and T. Roberts, "Dielectric Breakdown in High- ϵ Films for ULSI DRAM's: II. Barium-Strontium Titanate Ceramics," *Integrated Ferroelectrics*, Vol. 4, pp. 61-84, 1994.

D. Chen, M. Azuma, **L. D. McMillan**, and C.A. Paz de Araujo, "A Simple Unified Analytic Model for Ferroelectric Thin Film Capacitor and Its Application for Nonvolatile Memory Operation," presented at *The Ninth International Symposium on the Applications of Ferroelectrics*, University Park, PA, August 1994.

B.M. Melnick, M.C. Scott, **L. D. McMillan**, and C.A. Paz de Araujo, "Characterization of a Spin-On 70/30 BST Process," abstract presented at *The 6th International Symposium on Integrated Ferroelectrics*, Monterey, CA, March 1994.

Larry D. McMillanPublications and Presentations

T. Ito, S. Hiraide, H. Yoshimori, H. Watanabe, T. Mihara, C.A. Paz de Araujo, M.C. Scott, and **L. D. McMillan**, "Characteristics of Ultra Thin Y-1 for a 1V Non-volatile Memory," abstract presented at *The 6th International Symposium on Integrated Ferroelectrics*, Monterey, CA, March 1994.

J.D. Cuchiari, C.A. Paz de Araujo, B.M. Melnick, and **L. D. McMillan**, "The Effects of Bipolar Pulsed Fatiguing on the CV Characteristics of PZT and Y-1 Discrete Capacitors," abstract presented at *The 6th International Symposium on Integrated Ferroelectrics*, Monterey, CA, March 1994.

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M. Azuma, M. Huffman, S. Hayashi, M.C. Scott, **L. D. McMillan**, and C.A. Paz de Araujo, "Device Characteristics of Fatigue Free Y1 Deposited by LSCVD," presented at *The 6th International Symposium on Integrated Ferroelectrics*, Monterey, CA, March 1994.

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M. Huffman, **L. D. McMillan**, M.C. Scott, and C.A. Paz de Araujo, "Novel Liquid Source CVD Technique for Ferroelectric, High Dielectric Constant and Complex Oxide Thin Films," presented at *The 9th International Symposium on the Applications of Ferroelectrics*, University Park, PA, August 1994.

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PATENT # COUNTRY	DATE OF ISSUE	PATENT TITLE
45985 Singapore	03/30/99	Integrated Circuits Having Mixed Layered Superlattice Materials and Precursor Solutions For Use In A Process of Making The Same
53405 Singapore	09/21/99	Methods and Apparatus for Material Deposition Using Primer
56664 Singapore	11/16/99	Misted Precursor Deposition Apparatus and Method with Improved Mist Flow
56717 Singapore	03/14/97	Method and Apparatus for Fabricating Silicon Dioxide and Silicon Glass Layers in Integrated Circuits
DE 692 31 865 T 2 Germany	09/20/01	Layered Superlattice Material Applications
E201938 Austria	07/25/01	Layered Superlattice Material Applications
EP 0 616 723 Europe	06/20/01	Process For Fabricating Layered Superlattice Materials
EP 0 616 726 Europe	07/03/01	Layered Superlattice Material Applications
EP 0 665 814 Europe	01/15/97	Precursors and Processes for Making Metal Oxides
EP 0 665 981 Europe	03/20/02	Process For Fabricating Layered Superlattice Materials And Making Electronic Devices Including Same
EP 0 975 556 Europe	11/07/001	Method Of Forming Magnesium Oxide Films On Glass Substrate For Use In Plasma Display Panels
FR 0 616 726 France	06/06/01	Layered Superlattice Material Applications
NI 102545 Taiwan	08/19/99	Method and Apparatus for Fabricating Silicon Dioxide and Silicon Glass Layers in Integrated Circuits
NI 106205 Taiwan	12/30/99	Liquid Source Formation of Thin films Using Hexamethyl-Disilazane
NI 116293 Taiwan	01/10/01	Low Imprint Ferroelectric Material for Long Retention Memory and Method of Making the Same
NI 126 993 Taiwan	06/04/01	Misted Precursor Deposition Apparatus And Method With Improved Mist And Mist Flow
NI 130298 Taiwan	08/09/01	Ferroelectric Flat Panel Displays
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Taiwan		Other Precursor Properties
202,532 South Korea	03/29/99	Methods of Apparatus for Materials Deposition
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5,719,416 USA	02/17/98	Integrated Circuit with Layered Superlattice Material Compound
5,723,171 USA	03/03/98	Integrated Circuit Electrode Structure and Process for Fabricating Same
5,759,923 USA	06/02/98	Method and Apparatus for Fabricating Silicon Dioxide and Silicon Glass Layers in Integrated Circuits
5,784,310 USA	07/21/98	Low Inprint Ferroelectric Material for Long Retention Memory and Method of Making the Same
5,788,757 USA	08/04/98	Composition and Process Using Ester Solvents for Fabricating Metal Oxide Films and Electronic Devices Including the Same
5,792,592 USA	08/11/98	Photosensitive Liquid Precursor Solutions and Use Thereof in Making Thin Films
5,803,961 USA	09/08/98	Integrated Circuits having Mixed Layered Superlattice Materials and Precursor Solutions for Use in a Process of Making the Same
5,811,847 USA	09/22/98	PSZT for Integrated Circuit Applications
5,825,057	10/20/98	Process for Fabricating Layered Superlattice Materials and Making

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USA		Electronic Devices Including Same
5,840,110 USA	11/24/98	Integrated Circuits having Mixed Layered Superlattice Materials and Precursor Solutions for Use in a Process of Making Same
5,843,516 USA	12/01/98	Liquid Source Formation of Thin films Using Hexamethyl-Disilazane
5,846,597 USA	12/08/98	Liquid Source Formation of Thin films Using Hexamethyl-Disilazane
5,849,071 USA	12/15/98	Liquid Source Formation of Thin films Using Hexamethyl-Disilazane
5,871,853 USA	02/16/99	UV Radiation Process for Making Electronic Devices Having Low-Leakage-Current and Low-Polarization Fatigue
5,883,828 USA	03/16/99	Low Imprint Ferroelectric Material for Long Retention Memory and Method of Making the Same
5,888,583 USA	03/30/99	Misted Deposition Method of Fabricating Integrated Circuits
5,909,042 USA	06/01/99	Electrical Component Having Low-Leakage Current and Low Polarization Fatigue Made by UV Radiation Process
5,932,295 USA	08/03/99	Method and Apparatus for Misted Liquid Source Deposition of Thin Films with Increased Yield
5,942,376 USA	08/24/99	Shelf-Stable Liquid Metal Aryketone Alcoholate Solutions and Use Thereof in Photo Initiated Patterning of Thin Films
5,943,111 USA	08/24/99	Layered Superlattice Ferroelectric Liquid Crystal Display
5,955,754 USA	09/21/99	Integrated Circuits Having Mixed Layered Superlattice Materials and Precursor Solutions for Use in a Process of Making Same
5,962,085 USA	10/05/99	Misted Precursors Deposition Apparatus and Method with Improved Mist and Mist Flow
5,965,219 USA	10/12/99	Misted Deposition Method with Applied UV Radiation
5,966,318 USA	10/12/99	Nondestructive Readout Memory Utilizing Ferroelectric Capacitors Isolated From Bitlines by Buffer Amplifiers
5,972,428 USA	10/26/99	Methods and Apparatus for Material Deposition Using Primer
5,997,642 USA	12/07/99	Method and Apparatus For Misted Deposition of Integrated Circuit Quality Thin Films
6,017,579 USA	01/25/00	Method of Forming Magnesium Oxide Films on Glass Substrate for Use in Plasma Display Panels
6,022,669 USA	02/08/00	Method of Fabricating an Integrated Circuit Using Self-Patterned Thin Films
6,051,858	04/18/00	Ferroelectric/High Dielectric Constant Integrated Circuit and Method

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USA		of Fabricating Same.
6,056,994 USA	05/02/00	Liquid Deposition Methods of Fabricating Layered Superlattice
6,072,207	06/06/00	Process For Fabricating Layered Superlattice Materials And Making Electronic Devices Including Same
6,080,592 USA	06/27/00	Method of Making Layered Superlattice Materials for Ferroelectric, High Dielectric Constant, Integrated Circuit Applications
6,104,049 USA	08/15/00	Ferroelectric Memory With Ferroelectric Thin Film Having Thickness of 90 Nanometers or Less, and Method of Making Same
6,110,531 USA	08/29/00	Method and Apparatus for Preparing Integrated Circuit Thin Films by Chemical Vapor Deposition
6,116,184 USA	09/12/00	Method and Apparatus for Misted Liquid Source Deposition of Thin Film with Reduced Mist Particle Size
6,133,050 USA	10/17/00	UV Radiation Process for Making Electronic Devices Having Low-Leakage-Current and Low-Polarization Fatigue
6,143,063 USA	11/07/00	Misted Precursor Deposition Apparatus and Method with Improved Mist Flow
6,174,213 USA	01/16/01	Fluorescent Lamp and Method of Manufacturing Same
6,198,225 USA	03/06/01	Ferroelectric Flat Panel Displays
6,203,619 USA	03/20/01	Multiple Station Apparatus for Liquid Source Fabrication of Thin Films
6,258,733 USA	07/10/01	Method and Apparatus for Misted Liquid Source Deposition of Thin Film with Reduced Mist Particle Size
6,339,238 USA	01/15/02	Ferroelectric Field Effect Transistor, Memory Utilizing Same, And Memory of Operating Same
6,365,927 USA	04/02/02	Ferroelectric Integrated Circuit Having Hydrogen Barrier Layer
6,370,056 USA	04/09/02	Ferroelectric Memory And Method Of Operating Same
6,373,743 USA	04/16/02	Ferroelectric Memory And Method Of Operating Same
6,376,691 USA	04/23/02	Metal Organic Precursors For Transparent Metal Oxide Thin Films And Method Of Making Same
6,383,555 USA	05/07/02	Misted Precursor Deposition Apparatus And Method With Improved Mist And Mist Flow

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6,404,003 USA	06/11/02	Thin Film Capacitors On Silicon Germanium Substrate
6,413,883 USA	07/02/02	Method Of Liquid Deposition By Selection Of Liquid Viscosity And Other Precursor Properties
6,437,380 USA	08/20/02	Ferroelectric Device With Bismuth Tantalate Capping Layer And Method Of Making Same
6,441,414 USA	08/27/02	Ferroelectric Field Effect Transistor, Memory Utilizing Same, And Memory Of Operating Same
6,448,190 USA	09/10/02	Method And Apparatus For Fabrication Of Integrated Circuit By Selective Deposition Of Precursor Liquid
6,511,718 USA	01/28/03	Method And Apparatus For Fabrication Of Thin Films By Chemical Vapor Deposition
6,537,830 USA	03/25/03	Method Of Making Ferroelectric FET With Polycrystalline Crystallographically Oriented Ferroelectric Material
6,559,469 USA	05/06/03	Ferroelectric And High Dielectric Constant Transistors
6,582,972 USA	06/24/03	Low Temperature Oxidizing Method Of Making A Layered Superlattice Material
98909128.5-2111	03/12/98	Method of Forming Magnesium Oxide Films on Glass Substrate for Use in Plasma Display Panels